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(54) A stopper for deformable containers, incorporating an elastic diaphragm dispenser with a self-closing orifice, and method for the manufacture thereof.

(57) A stopper for deformable containers, comprising a dispensing device in the form of an elastic diaphragm (21) having at least one cross cut forming a self-closing orifice which opens to dispense out a product present within the container as a predetermined pressure is applied to the container from outside, and closes to automatically cut off the delivery of the product on removal of said pressure.

The diaphragm (21) is attached permanently and tightly in an irreversible manner to an inner flange (12) of the tubular wall (2) of the stopper intended for engagement with the container and merely laid on, without adhering to, the convex surface (16) of the top wall (1) of the stopper which is connected detachably to the tubular wall (2) and constitutes a temporary covering element.

The elastic diaphragm (2) is formed by a molding process performed directly within the stopper cavity using a predetermined metered amount of a thermoplastic elastomer material which is compressed against the inner surfaces of the caity to thereby permanently and tightly attach the edge (20) of the diaphragm (21)to just the flange (12) of the tubular wall (2) and make it detachable from the top wall (1) of the stopper, and then performing at least one through cut in the area corresponding to said top wall of the stopper.

The advantage is thus provided of making the stopper and self-closing dispensing device a unitary construction, and forming the elastic diaphragm from a thermoplastic elastomer material.

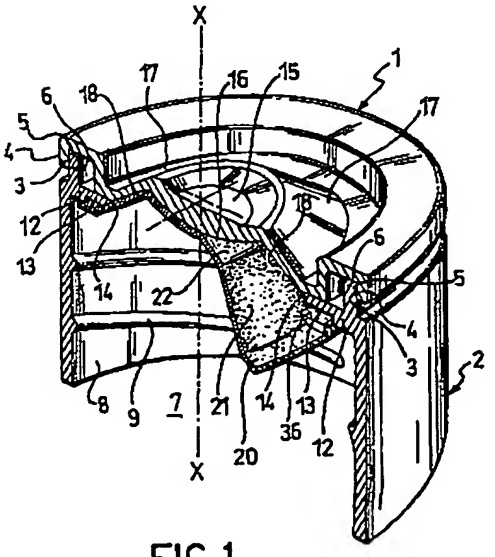

FIG.1

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This invention relates to a stopper for deformable containers provided with a neck portion defining an opening, being of a type formed as by molding from a plastics material with a top wall and a tubular wall depending therefrom for engagement with the container neck, said top wall being connected to the tubular wall by reversible coupling means, including a dispensing device in the form of an elastic diaphragm with at least one cross cut to provide a self-closing orifice which will open to dispense a product from the container interior on a predetermined pressure being applied to the container from outside, and close to automatically cut off the product delivery on such pressure being removed, said top wall of the stopper providing a temporary cover element for the dispensing device.

A stopper of the type specified hereinabove is disclosed in EP-A-0 160 336, for example, while the use and operation of diaphragm-type dispensing devices having a cross cut which opens to dispense out the product on the container walls being applied a compressive force from outside, as in the instance of a toothpaste tube, and automatically closes on removal of the externally applied compressive force, are also disclosed and illustrated in FR-A-986,998 and US-A-4,434,810. According with the documented prior art, it may be seen that the diaphragm with the cross cut which constitutes the self-closing dispensing member is provided on the stopper as a separate part to be first formed separately and then assembled to the unit forming the container closure. With specific reference to EP-A-0 160 336, it may be further seen that the elastic diaphragm constituting the self-closing dispensing member, also requires co-operation from the end of the container neck in order to be held in a working position, as well as co-operation from the other parts which constitute the stopper proper, such as the neck-engaging tubular wall and the top wall intended for removal and providing a temporary cover for the underlying diaphragm.

With reference to US-A-4,434,810, on the other hand, it may be seen that, while requiring no assistance from elements or parts of the container for holding it in a working position, the diaphragm functioning as a self-closing dispenser is again formed as a separate part from the stopper and then fitted to the stopper top wall within a specially provided seating arrangement and using coupling means which require the provision of corresponding complementary means on the diaphragm edges.

Thus, the diaphragm should be formed of necessity by a molding process in purposely arranged molds, which are relatively complicated, and using plastics materials which can acquire and retain complex structural characteristics, usually of the thermosetting variety.

Accordingly, the prior art exhibits a number of drawbacks, among which the use of relatively expensive materials, as are the thermosetting ones, the need to make specific molds available for forming the diaphragm as a separate part, the need to assemble the diaphragm and the stopper together, which all are bound to be cost-intensive when related to the particular type of end product of interest.

It is the object of this invention to eliminate or greatly the above drawbacks with which prior art stoppers are beset by providing a structure and manufacturing method whereby, on the one side, the self-closing diaphragm-type dispensing member can be formed directly on the stopper, and on the other side, more economical plastics materials can be used.

This object is achieved by a stopper as indicated being characterized as in Claim 1, and by a manufacturing method as defined in Claim 11.

The invention will be now described more in detail with reference to some practical embodiments thereof, given by way of non-limitative example and illustrated by the accompanying drawings, where:

Figure 1 a part-sectional perspective view of a first embodiment of a stopper according to the invention;

Figure 2 is a part-sectional perspective view of a second embodiment of the inventive stopper;

Figure 3 is a part-sectional perspective view of a third embodiment of the inventive stopper;

Figure 4 is a perspective view showing schematically the stopper of this invention fitted to a deformable container under dispensing conditions of a product present in the container;

Figure 5 shows the stopper of Figure 4 with the dispenser in the closed condition; Figure 6 is a plan view showing schematically the stopper interior prior to commencing the elastic diaphragm manufacturing steps in accordance with the method of this invention; and

Figures 7, 8, 9, 10 and 11 show steps of the elastic diaphragm manufacturing method.

With reference to the drawing figures, and specifically to Figure 1, it may be seen that this stopper comprises a top wall 1 and a tubular wall 2 connected to the former by reversible coupling means consisting, in the example shown, of a toroidal projection 3 carried on the bent lip 4 of the wall 1 and a mating slot 5 provided on an annular ridge 6 of the tubular wall 2. The walls 1 and 2 define, when coupled together, an internal cavity 7 having a longitudinal axis X-X. The inner surface 8 of the tubular wall 2 is provided with some conventional means, e.g. a threadway 9, for engagement with the neck portion 10 of a container 11.

The container to which this invention is related would be of the "squeeze" type, such as a toothpaste tube, or of the deformable type by application of an external compressive force but capable of recovering elastically its original shape on removal of the compressive force.

The tubular wall 2 is also provided, at a location close to the top wall 1, with a flange 12 which includes a horizontal section 13 extending perpendicularly to the axis X-X and an end section 14 which defines a conical surface tapering toward the top wall 1. The latter has a central portion 15 whose surface 16, facing the cavity 7, is convex, and an annular region 17 whose surface 18, also facing toward the cavity 7, is frusto-conical and lies in continuation of the conical surface to which the end section 14 of the flange 12 belongs. As shown best in Figure 6, the horizontal section 13 of the flange 12 has circumferentially arranged cuts 19 effective to provide stable and irreversible anchoring for the edge 20 of the elastic diaphragm 21 during its manufacture, which diaphragm will constitute, in the stopper environment, the self-closing dispensing member, as explained hereinafter.

This elastic diaphragm 21 has a central region 22 which is to bear on the convex surface 16 of the top wall 1 in a detachable manner. To promote the detach action, between the convex surface 16 and the region 22 of the diaphragm 21 there may be inserted an anti-adhesion material 23, such as silicone, as shown in Figures 7 to 11.

With particular reference to Figures 4 and 5, it may be seen that this diaphragm 21is provided, in its central region 22 with a cross-like cut 24. This provides a self-closing orifice which opens to deliver the product 25, such as a toothpaste, as an external pressure P is applied, as shown in Figure 4, to the deformable container 11, and closes automatically, to cut off the delivery of product, on removal of the external pressure, while depending on the elastic or inelastic character of the container 11, the container may recover its original spatial configuration.

With reference to Figures 2 and 3, it may be seen that homolgous parts of those previously described with reference to Figure 1, carry the same reference numerals, particularly as relates to the top 1 and tubular 2 walls. In accordance with the embodiment shown in Figure 2, the flange 12 has, additionally to the flat section 13 with the cuts 19, an intermediate section 26 which belongs to a conical surface tapering toward the top wall 1 of the stopper, followed by a tubular end section 27. The last-named section is coaxial with the tubular wall 2 but has a smaller diameter. It fits in reversible coupling relationship with a collar 28 which encircles the central region of the wall 1 whose inner surface 16 is convex like in the embodiment of Figure 1. This same tubular section 27 may, with the wall 1 removed and the stopper in the operative condition on a container, function as a pouring attachment or lead-out for the product being dispensed, with clear benefits in the instance of the product being liquid or oil-like.

With reference to the embodiment shown in Figure 3, it may be seen that, compared with that of Figure 2, the central region of the wall 1 whose surface 16 facing the cavity 7 is convex, has been provided with an annular ridge 29 which mates with a groove 30 in the elastic diaphragm 21, which takes here the form and function of annular bellows. This is specially advantageous to accommodate shrinkage of the thermoplastic material consequent to forming the elastic diaphragm 21 by the molding process, as explained hereinafter.

Turning now to Figures 6 to 11, the method may be appreciated for manufacturing the dispenser member of the elastic diaphragm type with self-closing cut directly onto the stopper body, according to this invention.

First, the stopper assembly basic parts consisting of the top wall 1 and the tubular wall 2 is molded and assembled. The plastics material employed in the manufacture to such parts is preferably polypropylene of high-density polyethylene having a softening temperature in the 190 to 200 degrees centigrade range. The molding technologies are conventional ones for such materials. The assembly is then placed upside down with the cavity 7 opening up as shown schematically in Figure 7. The convex 16 and frusto-conical 18 surfaces of the top wall 1 are preferably coated or sprinkled, as by means of a device shown schematically at 31, with a thin coat 23 of silicone or, more generally, of some conventional adhesion-preventing material to avoid that the elastic diaphragm 21 may attach itself to the wall 1 in the process of its formation. As explained hereinafter, in fact, thin provides a temporary covering for the diaphragm intended for removal on first use of the container and the stopper. Thereafter, as shown in Figure 8, a metered amount of a thermoplastic elastomer 32 is deposited over the central region of the convex surface 16 in a flowing state which has a softening temperature in the 140 to 150 degrees centigrade range, to thereby avoid damaging the material of which the wall 1 is made. The metered amount 32 of elastomer, preferably comprising styrene butadiene, is applied of preference through a nozzle schematically indicated at 33. Once the deposition of the metered amount 32 of elastomer material is completed and the nozzle 33 moved aside, a punch 34 is brought into play which, as shown in Figures 9 and 10, will mold under compression the charge 32 and thereby form the diaphragm 21. During this molding stage, the cavity 7

of the stopper will practically act as a mold. The profile shapes of the inner surfaces of the wall 1, the flange 12, and 35 of the punch 34 will determine the final configuration of the diaphragm 21 in the embodiments shown, while also taking into account their respective shrinkage rates to occur during the cooling stage. Throughout the molding process, the punch 34 would be heated by conventional heater means, not shown, thereby the plastic elastomer material intended to provide the edge 20 for the diaphragm being formed will also flood the cuts 19 in the flange 12 to form peduncles such as the one shown at 36 in Figure 1 to provide mechanical anchoring as well as hydraulic sealing.

Once the formation of the elastic diaphragm 21 is completed, and after removal of the punch 34, in the central region of the diaphragm itself, at a juxtaposed location to the convex surface 16 of the wall 1, there is formed at least one cut-through adapted to provide a self-closing orifice. This cut-through may be in the shape of a cross 24, as shown in Figures 4 and 5, and is made using a specially provided shearing punch shown schematically at 37 in Figure 11.

At this point, after the punch 37 is retracted, the stopper is to be regarded as finished and ready for use in association with a container 11 for dispensing a liquid or pasty product in the way discussed hereinabove and with the advantages already set forth.

On first use, the top wall 1 would be detached from the tubular wall 2 by acting on the reversible coupling means. Thus, the central region 22 and respective cut-through 24 in the elastic diaphragm 21 become exposed, with the latter firmly and tightly anchored by its edge 20 on the flange 12 of the stopper tubular wall 2.

It will be appreciated from the foregoing description that, with this invention, the elastic diaphragm can be made to have a much smaller thickness dimension than that required where the diaphragm is manufactured as a separate item and then manipulated for assembling to the stopper. In addition, through it being practically formed integral with the tubular wall of the stopper, as the latter is screwed down onto the container, no strains are applied which may result in it becoming deformed, as is instead the case with diaphragms according to the prior art.

Claims

1. A stopper for deformable containers provided with a neck portion defining an opening, being of a type formed as by molding from a plastics material with a top wall and a tubular wall depending therefrom for engagement with the container neck, said top wall being connected to the tubular wall by reversible coupling means, including a dispensing device in the form of an elastic diaphragm with at least one cross cut to provide a self-closing orifice which will open to dispense a product from the container interior on a predetermined pressure being applied to the container from outside, and close to automatically cut off the product delivery on such pressure being removed, said top wall of the stopper providing a temporary cover element for the dispensing device, characterized in that said diaphragm (21) is permanently attached in tight relationship and irreversible manner by its peripheral edge (20) to the stopper tubular wall (2) at the end thereof facing the top wall (1), and bears on the latter in a detachable manner, said tubular wall (2) being provided on its interior with a flange (12) for irreversible attachment in a tight manner of said peripheral edge (20) of the diaphragm.

2. A stopper according to Claim 1, characterized in that said elastic diaphragm is made of a thermoplastic elastomer having a softening temperature in the 140° to 150° C range.

3. A stopper according to Claim 2, characterized in that said thermoplastic elastomer is styrene butadiene.

4. A stopper according to Claims 1 to 3, characterized in that the top wall and adjoining tubular wall are formed from a thermoplastic polymer material having a softening temperature in the 190° to 200° C range.

5. A stopper according to Claim 4, characterized in that said polymer material is high-density polyethylene.

6. A stopper according to Claims 1 to 5, characterized in that the surface (16) of the central region (15) of said top wall (1) facing the interior of the cavity (7) defined by the tubular wall (2) connected thereto is a convex surface.

7. A stopper according to claims 1 to 6, characterized in that said flange (12) for irreversible tight attachment of the edge (20) of said diaphragm (21) comprises a substantially flat annular section (13) lying perpendicularly to the longitudinal axis (X-X) of the tubular wall (2) and provided with a plurality of circumferentially arranged cuts (19) and an end section (14) which belongs to a conical surface tapering toward said top wall (1).

8. A stopper according to Claims 1 to 7, char-

acterized in that said top wall has a frusto-conical annular region (17) which, with the wall in the coupled condition with the tubular wall (2), extends in continuation of the conical surface of said end section (14) of the flange along the taper direction.

9. A stopper according to Claims 1 to 6, characterized in that said flange for irrevrsible tight attachment of the edge (20) of said diaphragm comprises a substantially flat annular section (13) lying perpendicular to the longitudinal axis (X-x) of the tubular wall and being provided with a plurality of circumferentially arranged cuts (19), an intermediate section (26) belonging to a conical surface tapering toward said top wall (1) and a tubular end section (27), coaxial with said tubular wall and having a smaller diameter than the latter, said end section (27) being connectable in reversible fit relationship with a collar (28) on said top wall.

10. A stopper according to Claim 9, characterized in that the central region with convex surface (16) of said top wall (1) is encircled by an annular ridge (29) and said elastic diaphragm (21) is formed with a groove (30) mating with said ridge.

11. A method of manufacturing a stopper as set forth in Claims 1 to 10, characterized in that it comprises the steps of arranging, in an upside down attitude with the opening (7) upwards, the assembly formed of the top wall (1) and the tubular wall (2) as assembled together, depositing a metered amount (32) of a thermoplastic elastomer material in a flowing state over the convex central region (16) of said top wall (1), compression molding of said metered amount of elastomer material against the surfaces (16,18) of said top wall (1) and (13,14,26,27) of said flange (12) of the tubular wall (2) which are facing toward the cavity (7) defined by the tubular wall, with consequent formation of said elastic diaphragm (21), irreversibly and tightly adhering the edge (20) of said diaphragm to said flange (12) only of the tubular wall at least as relates to the flat annular section (13) of said flange, and providing at least one through cut (24) across the diaphragm thus formed in the area thereof juxtaposed to the convex surface (16) of said top wall (1).

12. A method according to Claim 11, characterized in that it includes the step of depositing an adhesion-preventing material (23) over the entire surface (16,18) of said top wall (1) facing the cavity (7) defined by the tubular wall (2), prior to depositing the metered amount (32) of thermoplastic elastomer material.

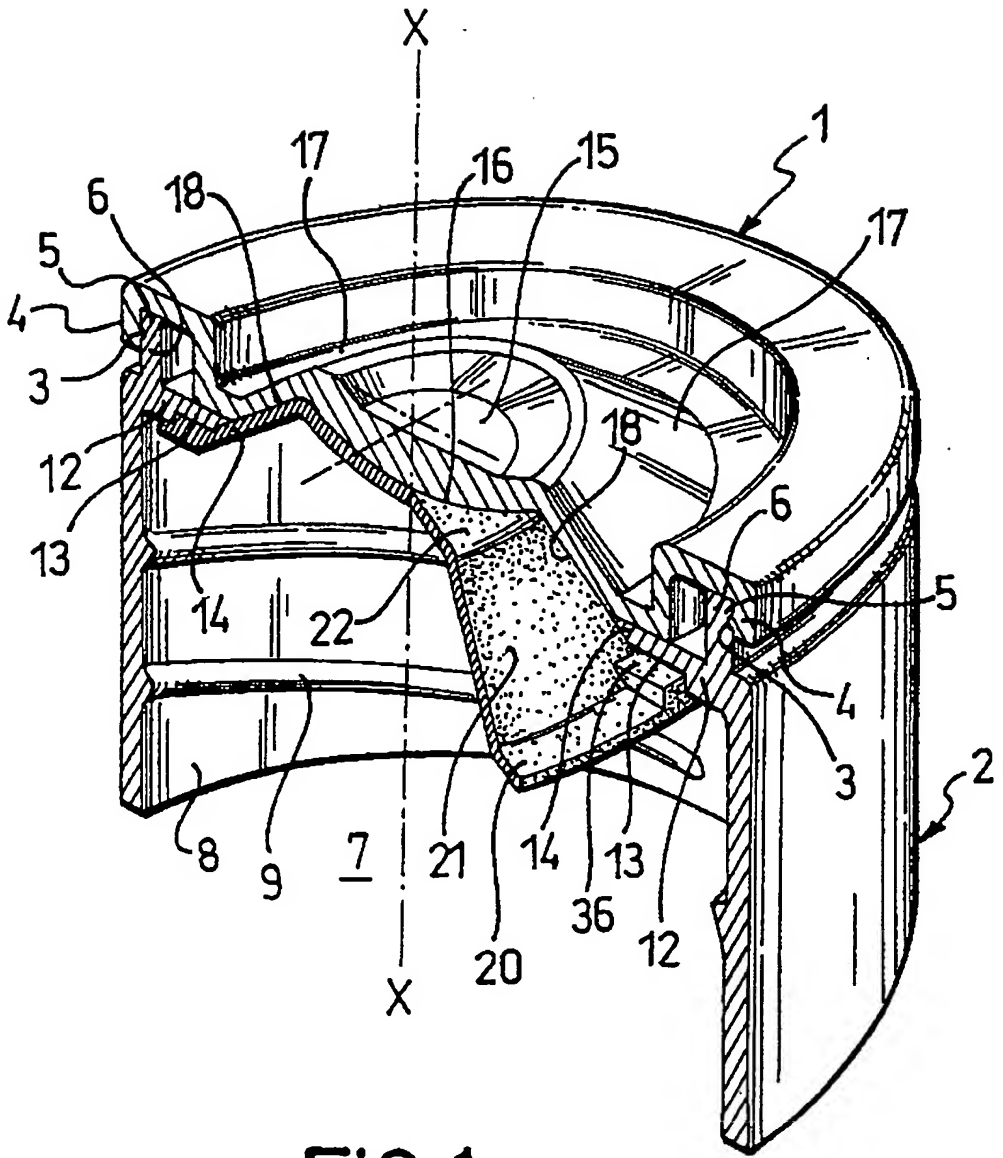

FIG.1

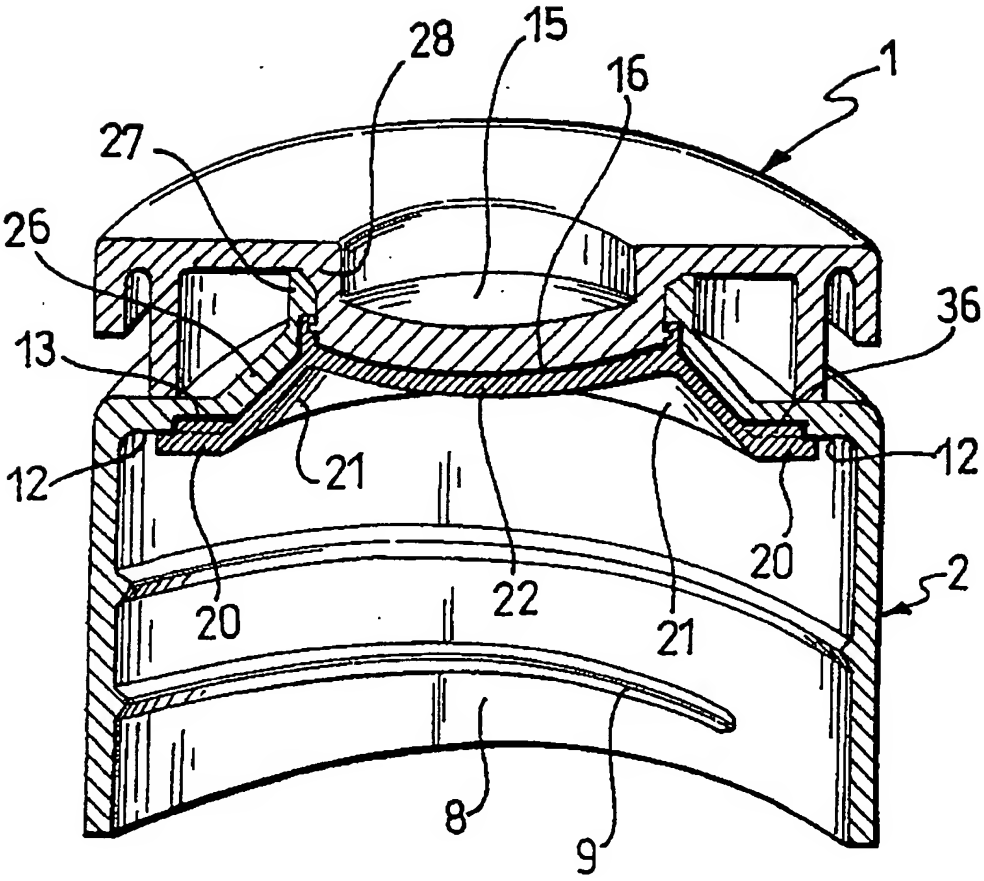

FIG.2

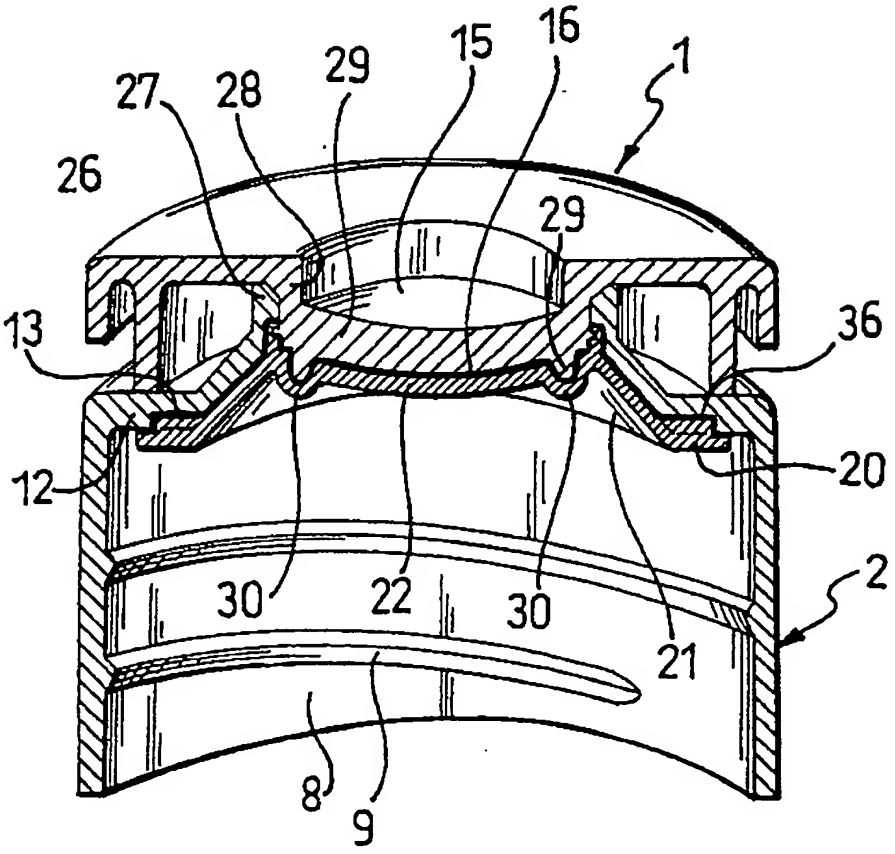

FIG.3

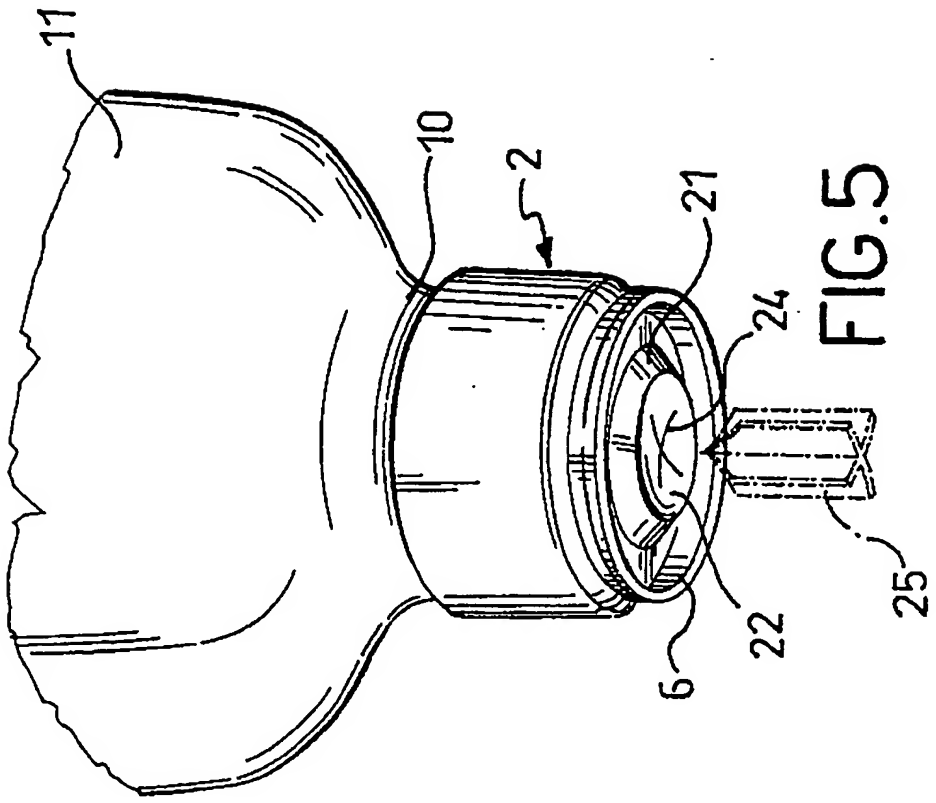

FIG.5

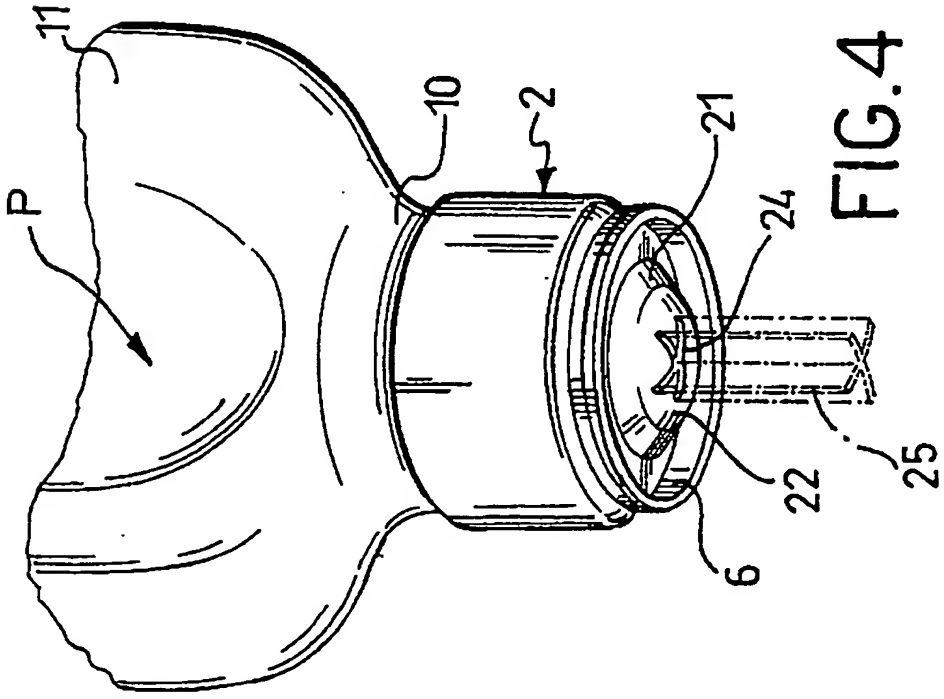

FIG.4

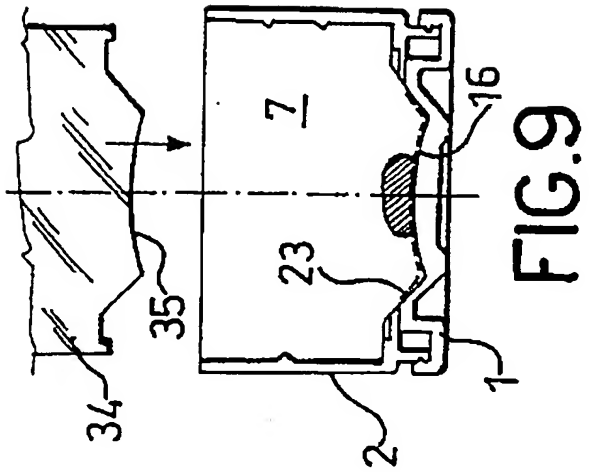

FIG.9

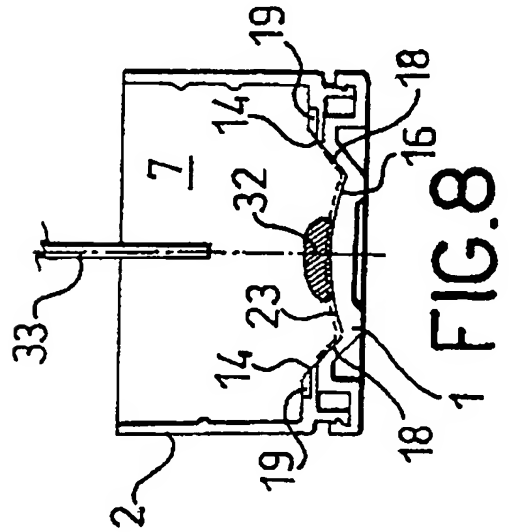

FIG.8

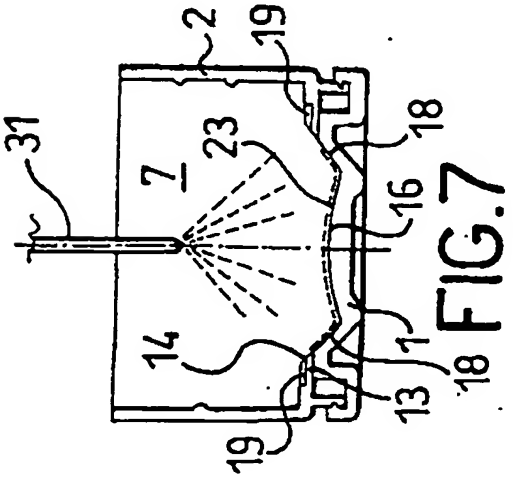

FIG.7

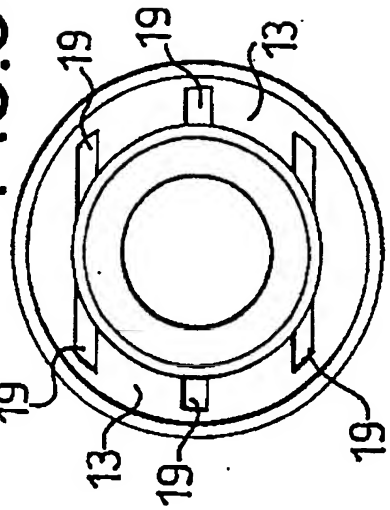

FIG.6

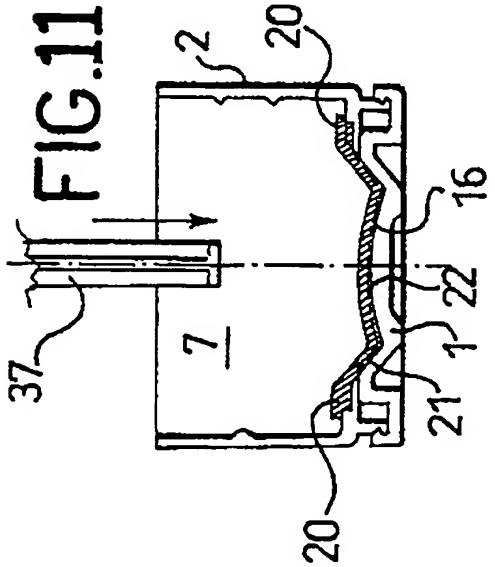

FIG.11

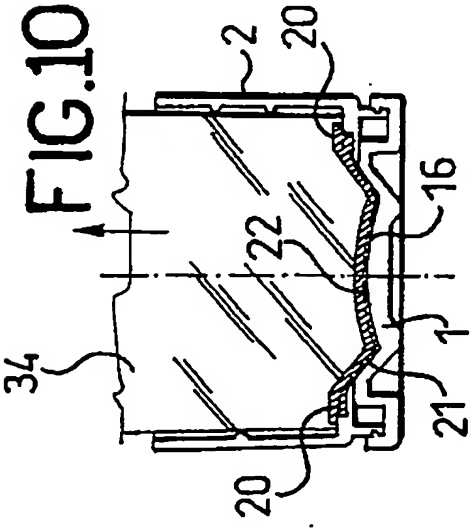

FIG.10